

## REMARKS

Claims 28-30 have been added. No new matter was added. Accordingly, claims 1-3, 7, 8 and 13-30 are pending for prosecution. Applicants submit arguments and a Terminal Disclaimer for overcoming the rejections of independent claims 1, 7 and 8 over the prior art of record. Therefore, Applicants respectfully submit that the present application is in condition for allowance.

### I. Priority

*In the Office Action, it is noted that "Applicant has not filed a certified copy of the JP 2003-97659 application as required by 35 U.S.C. 119(b)."*

The present application is the U.S. national phase of International PCT Application No. PCT/JP04/01915 filed on February 19, 2004. The certified copy of the priority application, JP 2003-97659, was properly and timely submitted by Applicants to the International Bureau during the International phase of the application. Accordingly, Applicants respectfully request that the U.S. Examiner acknowledge that the certified copy has been properly received in the present U.S. national phase application.

### II. Claim Objections

*In the Office Action, correction of a typographical error in claim 17 is requested.*

Claims 17 and 21 of the present application have been amended to correct a typographical error. The word “from” has been replaced with the word “form” in each of the claims. No new matter was added. Applicants respectfully request removal of the objection.

### III. Claim Rejections - 35 USC §102(b)

*In the Office Action, claims 8 and 21-27 are rejected under 35 USC §102(b) as being anticipated by U.S. Patent No. 6,193,821 B1 issued to Zhang.*

There is a significant difference between the sputtering target and method taught by Zhang and that of the present invention. Zhang discloses a tantalum sputtering target having a recrystallized structure (similar to that shown in FIGs. 3 and 4 of the present application with respect to conventional tantalum sputtering targets). In contrast, the present invention is drawn to a tantalum sputtering target and method of making a tantalum sputtering target in which the target is provided with a non-recrystallized structure. See the illustrations of such a structure in FIGs. 1 and 2 of the present application and the discussion of such a structure on page 8, lines 4-23, and page 9, lines 25-26, of the present application.

It is evident from various statements made in the Zhang patent that Zhang produces a recrystallized target structure. For example, on column 2, lines 30-32, the Zhang patent discusses prior art tantalum targets and methods and states that:

“Since the metal is *only slightly worked*, high temperatures, on the order of 1500°C, are required to *fully anneal* the billets.”

Here, the term “fully anneal” is referring to fully recrystallizing the billet after forging and/or rolling.

Compare the above statement with that on column 4, lines 1-7, of the Zhang patent which states:

“This step 50 is followed by a vacuum anneal of at a temperature of about 900°C to about 1200°C. It should be noted that, *due to the heavy working* of the metal during the side-forging and side-rolling step, the approximate 900°C to 1200°C annealing temperature is lower than the annealing temperature typically used in connection with prior art processes, typically about 1500°C.”

This same general statement is repeated two more times in the Zhang patent on column 3, lines 13-19, and column 4, lines 15-20. On column 3, lines 15-19, Zhang states that lower temperatures are used for the sole purpose of “reducing manufacturing costs” and that the use of lower temperatures is enabled due to the new “heavy working” process steps required by Zhang. Accordingly, based on these statements, it is clear that Zhang is aiming to achieve and is achieving the same recrystallized target structure as that of conventional tantalum sputtering targets that have traditionally been annealed at a temperature of 1500°C. This recrystallization annealing temperature can be reduced in Zhang due to the heavy working required by Zhang. However, even with the reduced temperature, the same recrystallization result is desired and achieved as that of conventional targets.

Accordingly, the clear intent and teaching of Zhang is to provide the tantalum sputtering target with a recrystallized structure the same as that of conventional targets. Although Zhang teaches the use of a temperature of 900°C to about 1200°C, it still produces a recrystallized structure due to the heavy working. Thus, Zhang clearly fails to disclose the non-recrystallized target structure of the present invention. In fact, Zhang fails to even recognize or understand the problems with recrystallized tantalum sputtering target structures disclosed by the present application and certainly does not provide a solution to such problems.

Further, Zhang discloses vacuum annealing during intermediate processing steps. For example, vacuum annealing is performed after “step 50” and “step 60” as illustrated in FIG. 2 of Zhang and discussed on column 3, line 63, to column 4, line 20, of the Zhang patent. These are clearly intermediate processing steps, and these annealing steps are not performed after the final plastic working as required by claim 8 of the present application. Also the object and effect of these steps are different. In Zhang, the annealing steps are for recrystallization, as discussed above. In contrast, the annealing after the final plastic working of the present invention is to

leave the processed structure after the plastic working and simply alleviate plastic working strain, not recrystallize the target.

For these reasons, Applicants respectfully submit that claims 8 and 21-27 are patentable and not anticipated by the Zhang patent.

Additional claims 28-30 have been added and depend from independent claim 8. These claims provided additional reasons for patentability. Claim 28 requires a method that provides the tantalum sputtering target with a non-recrystallized structure. No new matter was added; for example, see the same limitation stated in claim 7 of the present application.

Claims 29 and 30 include limitations that further limit the annealing temperature used after final plastic working. No new matter was added. For example, see the “Final Heat Treatment Temperature” taught on page 12, Table 1, for Examples 1-4 of the present application, as filed. These temperatures are clearly not taught, disclosed, suggested or contemplated by Zhang.

Accordingly, new dependent method claims 28-30 are submitted as being patentable over the Zhang patent.

#### IV. Claim Rejections - 35 USC §103(a)

*In the Office Action, claims 1-3, 7 and 13-20 are rejected under 35 USC §103(a) as being obvious over U.S. Patent No. 6,193,821 B1 issued to Zhang in view of U.S. Patent No. 4,994,118 of Pircher et al.*

For reasons already stated, Zhang clearly fails to disclose, teach or suggest a tantalum sputtering target having a “non-recrystallized structure”, which is required by each of independent claims 1 and 7 of the present application. This is discussed above in detail with respect to the §102(b) rejection and is also admitted in the Office Action, for instance, by the

statement: "Zhang differs from claim 1 in that Zhang does not disclose the tantalum sputtering target has a non-recrystallized structure."

To overcome this admitted deficiency of Zhang, the secondary Pircher et al. patent is cited and the following reason for modifying the tantalum sputtering target of Zhang in view of Pircher et al. is stated in the Office Action, as follows:

"It would have been obvious to one of ordinary skill in the art to modify Zhang in view of Pircher et al. because in col. 1 line 59 to col. 2 line 6, Pircher et al. disclose the method of performing finish rolling on a metal or metal alloy in the non-recrystallization range. One would have been motivated to modify Zhang in view of Pircher et al. because it is well known in the art that performing finishing steps on a metal or metal alloy in the non-recrystallization range results in **a higher mechanical strength** of the final product."

Applicants respectfully disagree with the above analysis and respectfully submit that claims 1-3, 7 and 13-20 are patentable over the cited combination of Zhang in view of the Pircher et al. patent. Accordingly, for each of the reasons discussed below, Applicants respectfully request careful and fair reconsideration and withdraw of the above stated rejection.

More specifically, Applicants submit that the subject matter required by claims 1-3, 7 and 13-20 are not obviated by Zhang in view of Pircher et al. for each of the following reasons:

- (i) the Pircher et al. patent is in a non-analogous field relative to tantalum sputtering targets and thus its combination with Zhang would not be obvious to one of ordinary skill in the art;
- (ii) Zhang teaches away from the present invention thus one of ordinary skill in the art would not modify Zhang in a manner that contradicts the teachings of Zhang;
- (iii) the combination of Zhang with Pircher et al. is improper because it is based on hind sight and is made using Applicants' disclosure as a blueprint to reconstruct and piece together the claimed invention out of isolated teachings in the prior art; and

(iv) a proper *prima facie* case of obviousness cannot be made under 35 USC §103(a) with Zhang in view of Pircher et al. because there is no adequate rationale for combining the prior art to attain the claimed invention.

(i) The Pircher et al. Patent is in a Non-Analogous Field

The present invention and Zhang relate to a tantalum sputtering target. For example, see column 1, lines 15-31, of Zhang for a general disclosure of the field of sputtering targets. The present invention aims to improve the deposition speed and uniformity of a thin film formed by a tantalum sputtering target and to obtain a tantalum sputtering target that does not generate arcing and particles during sputtering operations.

In contrast, the Pircher et al. patent relates to steel and the steelmaking industry. It aims to improve the surface strength of the hot rolled strip or heavy plate of steel. Pircher et al. disclose nothing with respect to sputtering targets and how to improve sputtering and the formation of thin films during a sputtering operation.

Accordingly, the technology disclosed by Pircher et al. and the technologies disclosed by Zhang and the present invention clearly are directed to different technical fields. Thus, one of *ordinary* skill in the art with respect to sputtering targets and the formation of thin films used in the semiconductor industry is provided with no *common sense* reason for looking to the steelmaking industry with respect to how to improve sputtering targets and sputtering operations.

For at least this reason, Applicants respectfully submit that claims 1-3, 7 and 13-20 are patentable over Zhang in view of the Pircher et al. patent.

(ii) Zhang Teaches Away from the Present Invention

"Teaching away" is the antithesis of the art suggesting that the person of ordinary skill in the art go in the claimed direction. Essentially, "teaching away" is a per se demonstration of lack of obviousness. In re Fine, 873 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Applicants respectfully submit that Zhang teaches away from the present invention as recited in claims 1-3, 7 and 13-20 of the present application. The teachings of Zhang direct one of ordinary skill in the art to recrystallize the tantalum sputtering target during a vacuum annealing step to provide the same recrystallized structure as that of conventional tantalum sputtering targets. Thus, one of ordinary skill in the art following the teachings of Zhang would fully anneal the target structure so as to fully recrystallize the target structure.

The fact that Zhang requires its tantalum sputtering target to have a recrystallized structure is evident from various statements made in the Zhang patent. On column 2, lines 30-32, the Zhang patent discusses prior art tantalum targets and methods and states that:

"Since the metal is only slightly worked, high temperatures, on the order of 1500°C, are required to fully anneal the billets."

Here, the term "fully anneal" is referring to fully recrystallizing the billet after forging and/or rolling.

Compare this statement with that on column 4, lines 1-7, of the Zhang patent which states:

"This step 50 is followed by a vacuum anneal of at a temperature of about 900°C to about 1200°C. It should be noted that, due to the heavy working of the metal during the side-forging and side-rolling step, the approximate 900°C to 1200°C annealing temperature is lower than the annealing temperature typically used in connection with prior art processes, typically about 1500°C."

This same general statement is repeated two more times in the Zhang patent on column 3, lines 13-19, and column 4, lines 15-20. On column 3, lines 15-19, Zhang states that lower

temperatures are used for the sole purpose of “reducing manufacturing costs” and that the use of lower temperatures is enabled due to the new “heavy working” process steps required by Zhang. Accordingly, based on these statements, it is clear that Zhang is aiming to achieve and is achieving the same recrystallized target structure as that of conventional tantalum sputtering targets that have traditionally been annealed at a temperature of 1500°C. This recrystallization annealing temperature can be reduced in Zhang due to the heavy working required by Zhang. However, even with the reduced temperature, the same recrystallization result is desired and achieved as that of conventional targets.

Accordingly, the clear intent and teaching of Zhang is to provide the tantalum sputtering target with a recrystallized structure the same as that of conventional targets.

For this reason, it would not be obvious for one of ordinary skill in the art to modify Zhang in a manner that is completely opposite to that actually taught by Zhang. A fully recrystallized target structure is taught by Zhang and by conventional tantalum sputtering target art. Completely reversing this aspect of Zhang would not be obvious to one of ordinary skill in that art. Accordingly, Applicants respectfully submit that claims 1-3, 7 and 13-20 are patentable over Zhang in view of the Pircher et al. patent.

(iii) The Zhang/Pircher et al. combination is based on hindsight

The Federal Circuit has repeatedly warned against using an applicant’s disclosure as a blueprint to reconstruct the claimed invention out of isolated teachings in the prior art. See, for instance, Grain Processing Corp. v. American Maize-Products, 840 F.2d 902, 5 USPQ2d 1788 (Fed. Cir. 1988). A critical step in analyzing the patentability of claims pursuant to a §103 rejection is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references. Close adherence to this

methodology is especially important in cases where the very ease with which the invention can be understood may prompt one “to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher.”

Applicants respectfully submit that the rejection based on the combination of Zhang with Pircher et al. improperly relies on hindsight analysis. There is no fair teaching, suggestion, or incentive provided by Zhang that would lead one of ordinary skill in the art to alter the conventional recrystallized target structure. Zhang teaches a reduction in annealing temperature based on the additional “heavy working” required by Zhang; however, the reduced temperature is still used to produce a recrystallized tantalum target structure according to conventional teachings. Further, there is no fair teaching, suggestion or incentive provided by Pircher et al. with respect to anything concerning sputtering targets and how to improve sputtering operations.

Accordingly, Applicants respectfully submit that a rejection based on Zhang modified according to Pircher et al. can only logically be made by using Applicants’ own disclosure in their application as a blueprint for piecing together the isolated teachings of Zhang and the Pircher et al. patent. However, hindsight analysis is improper. The references alone must suggest the combination.

Accordingly, it would not be obvious for one of ordinary skill in the art attempting to improve sputtering targets and operations of sputtering thin films to modify the recrystallized tantalum sputtering target of Zhang according to the steel industry teachings of the Pircher et al. patent. For at least this reason, Applicants respectfully submit that claims 1-3, 7 and 13-20 are patentable over Zhang in view of the Pircher et al. patent.

(iv) No Adequate Rationale for Combining Zhang and Pircher et al.

Applicants respectfully submit that the Board of Patent Appeals has consistently held that rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulate reasoning with rational underpinning to support the legal conclusion of obviousness.

In the Office Action, the reasoning for modifying Zhang in view of Pircher et al. is to achieve “a higher mechanical strength of the final product”. Applicants respectfully submit the stated rationale is an unsupported assertion and a mere conclusory statement. As such, the stated rationale is insufficient to support the legal conclusion of obviousness.

Sputtering targets are relatively small plates or discs of material that are used in sputtering operations to form thin films. For example, see column 1, lines 15-45, of the Zhang patent. Minute particles are eroded from a face of the target by ion bombardment and deposit on a substrate to form a thin film used for instance in the semiconductor industry. The target merely needs to be sufficiently strong to endure the sputtering operation. In fact, many sputtering targets are made of brittle materials. Thus, the term “strength” with respect to sputtering targets merely refers to a target that will not crack during manufacture, transportation and mounting within a sputtering chamber and will not crack due to the sputtering operation itself. This “strength” does not refer to its ability to support loads or the like expected of products produced by the steelmaking industry.

Further, one of the purposes of recrystallizing sputtering target structures is to increase the strength of the structure. For example, see page 1, line 27, to page 2, line 1, of the present application that discloses that recrystallization improves the strength of the target.

Still further, the present invention does not provide a non-recrystallized structure to increase or decrease target strength. Rather, the present invention aims to improve the deposition

speed of the target and uniformity of the film produced during a sputtering operation. The present invention also aims to provide a target that does not generate arcing and particles during sputtering operations. For example, see page 4, lines 14-19, of the present application, as filed.

Accordingly, Applicants respectfully submit that the rationale of providing “a higher mechanical strength of the final product” is an unsupported assertion and a conclusory statement with respect to sputtering targets. Pircher et al. relates to steel products produced by the steelmaking industry. The objective of Pircher et al. is to improve the surface strength of hot rolled strip of steel or a heavy plate of steel. Steel is obviously used in various manners to support loads and the like. In contrast, the present invention relates to a sputtering target. It needs only to have enough strength not to fracture during manufacture, transportation and mounting to a backing plate within a sputtering chamber and use during a sputtering operation. It is not required to support loads or the like. Thus, one of ordinary skill in the art in sputtering targets would not be concerned with strength as compared to one of ordinary skill in the art in the steel making industry. Further, recrystallization annealing is conventionally used to “strengthen” sputtering targets.

For this reason, Applicants respectfully submit that a proper *prima facie* case of obviousness cannot be made under 35 USC §103(a) with Zhang in view of the Pircher et al. patent. This is because an adequate rationale for combining the prior art to attain the claimed invention cannot be articulated. Accordingly, Applicants respectfully submit that claims 1-3, 7 and 13-20 are patentable over Zhang in view of the Pircher et al. patent.

## **V. Claim Rejections – Double Patenting**

*In the Office Action, claims 1, 7 and 8 are provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 2, 11 and 12 of co-pending application No 10/532,473.*

A Terminal Disclaimer is being filed with respect to co-pending application No. 10/532,473. Accordingly, Applicants respectfully request reconsideration and removal of the rejection.

## **VI. Conclusion**

In view of the above amendments, remarks, and Terminal Disclaimer, Applicants respectfully submit that the claim rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

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